REMARKS

Paoli 102(b) rejection

Claims 1, 2, 4, 5, 8-13, 23, 24, and 41 are rejected under 35 U.S.C. 102(b) as being anticipated by Paoli, U.S. Patent 5,317,170. Applicants respectfully traverse the rejection. Paoli recites, at column 12 lines 25-34, a laser array with "fresnel lenses 178 . . . formed on the exposed n-contact layer 180 over the emitter surface areas 182. . . . A fresnel lens 178 is formed for each individual laser element by ion milling or reactive ion etching . . ."

Claim 1 is canceled. Claim 3, the claim from which claims 2, 4, and 8-11 depend, recites "pressing a stamping block against at least one surface of said semiconductor light emitter." Claim 12, from which claims 13, 23, and 24 depend, recites "a first optical element stamped on at least one surface of said semiconductor light emitter." Claim 41 is amended to recite "one of a Fresnel lens and a holographic diffuser stamped on a surface of said semiconductor light emitter." Since Paoli teaches only ion milling or reactive ion etching and not stamping, Paoli does not anticipate claims 1, 2, 4, 8-13, 23, 24, and 41.

It would not have been obvious to substitute stamping as recited in claims 3 and 12 for the ion milling or reactive ion etching techniques used by Paoli to form fresnel lenses. In claims 3 and 12, an optical element, fresnel lens, or holographic diffuser is stamped on a surface of a semiconductor light emitter. Since the surfaces of semiconductor light emitters are generally crystalline and very hard, stamping is far more difficult than ion milling or reactive ion etching and far less likely to successfully form an optical element, fresnel lens, or holographic diffuser.

In addition, regarding claim 4, contrary to the Examiner's assertion on page 3 of the office action, Applicants can find no teaching in Paoli that the forming of a Fresnel lens or holographic diffuser "is executed concurrently with a wafer-bonding process, said wafer-bonding process comprising: removing a first substrate of said semiconductor light emitter;

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and bonding a second substrate to said semiconductor light emitter" as recited in claim 4. Accordingly, claim 4 is allowable for this additional reason.

Claim 5 is amended to recite "forming at least one of Fresnel lens and holographic diffuser on at least one surface of a semiconductor light emitter to affect light emitted by said semiconductor light emitter; wherein said forming comprises at least one method selected from ablation, machining, scribing, electron discharge machining, and stamping." Since Paoli teaches only ion milling or reactive ion etching and not the techniques recited in claim 5, Paoli does not anticipate claim 5. In addition, it would not be obvious to substitute the techniques recited in claim 5 for the ion milling and reactive ion etching taught by Paoli, because a person of skill in the art would expect the techniques of claim 5 to be more difficult and less likely to succeed than ion milling and reactive ion etching. Accordingly, claim 5 is allowable over Paoli.

Ito et al. 102(b) rejection

Claims 27, 29, 34, and 45-47 are rejected under 35 U.S.C. 102(b) as being anticipated by Ito et al. U.S. Patent 5,130,531. Applicants respectfully traverse the rejection. Claim 27 teaches "stamping at least one optical element on at least one surface of a semiconductor light emitter." Claim 34 teaches "at least one optical element stamped on at least one surface of said semiconductor light emitter." Thus, claims 27 and 34 both teach forming an optical element on the surface of a semiconductor light emitter. In contrast, Ito et al. teach in Fig. 11 "a micro Fresnel lens 55 with a profile formed by use of a resin of an ultraviolet setting type." See column 10, lines 20-22. Ito et al.'s light emitting diode 53 is separated from lens 55 by mold resin 60, adhesive agent 61, and glass substrate 54. Accordingly, Ito et al. do not teach an optical element formed on the surface of a semiconductor light emitter as recited in claims

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27 and 34. Claim 29 depends from claim 27 and therefore is allowable for at least the same reason.

Claim 45 is amended to recite "stamping an optical element in a material, said material being transparent to light emitted from said light emitting device, said material being one of high index optical glass, III-V semiconductors, II-VI semiconductors, group IV semiconductors, high-index organic semiconductors, high index organic compounds, and mixtures or alloys thereof." As described above, Ito et al. teach that the Fresnel lens is formed from resin. Accordingly, Ito et al. do not anticipate claim 45. In addition, it would not be obvious to substitute the materials recited in claim 45 for Ito et al.'s resin, since a person of skill in the art would expect forming an optical element in the materials recited in claim 45 to be more difficult and less likely to succeed than forming a Fresnel lens in resin. Claim 45 is therefore patentable over Ito et al.

Claims 46 and 47 and new claims 50 and 51 depend from claim 45 and are therefore patentable over Ito et al. for at least the same reason. In addition, Applicants can find no teaching in Ito et al. that "bonding comprises bonding said material to a semiconductor light emitter with a bonding material, said bonding material being one of high index optical glass, III-V semiconductors, II-VI semiconductors, group IV semiconductors, high-index organic semiconductors, high index organic compounds, and mixtures or alloys thereof" as recited in claim 50 or that "bonding comprises pressing said material together with said semiconductor light emitter at a temperature greater than room temperature" as recited in claim 51. Claims 50 and 51 are therefore allowable over Ito et al. for these additional reasons.

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Tomomura et al. 102(b) rejection

Claim 43 is rejected under 35 U.S.C. 102(b) as being anticipated by Tomomura et al. U.S. Patent 4,988,579. Applicants respectfully traverse the rejection. Claim 43 recites a

display device wherein "at least one of said blue light emitting device, green light emitting device, and red light emitting device comprises: a semiconductor light emitter; and one of a Fresnel lens and a holographic diffuser stamped on a surface of said semiconductor light emitter." In contrast, as is clear from Fig. 8, Tomomura et al.'s Fresnel lens 131 is formed within the semiconductor light emitter, not on the surface. Accordingly, Tomomura et al. does not anticipate claim 43.

Paoli, Shimada et al. 103(a) rejection

Claims 3, 27-30, 34, 42, and 45-47 are rejected under 35 U.S.C. 103(a) as being unpatentable over Paoli in view of Shimada et al., U.S. Patent 4,689,652. The Examiner states on pages 7-8 of the office action "Shimada et al. does teach stamping at least one optical element and that stamping is done on at least one of a semiconductor layer and a substrate layer of said semiconductor light emitter as described in column 8, lines 15-35." Applicants respectfully traverse the rejection. Shimada et al. teaches:

> At first, a photoresist is applied over the substrate surface, and the annular zone pattern is printed on the surface of the photoresist layer with the aid of an electron beam irradiation apparatus. In each annular zone, the beam intensity or exposure time is varied in the radial direction of the Fresnel lens, to thereby vary the polymerization degree of the photoresist. In this way, the individual annular zones printed or depicted on the photoresist are converted into stepped setbacks in cross-section thereof. By using the photoresist layer shaped in this manner as a stamping die, the Fresnel lens shown in FIG. 8B can be realized.

Shimada et al. teaches a stamping die made of photoresist. Applicants respectfully submit that there is no motivation to use such a stamping die to form Paoli's Fresnel lens because a person of skill in the art would not expect such a stamping die to be strong enough to stamp a surface of a semiconductor emitter.

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Claim 3 recites "forming at least one of Fresnel lens and holographic diffuser . . . wherein said forming comprises pressing a stamping block against at least one surface of said semiconductor light emitter." Claim 27 recites "stamping at least one optical element on at

least one surface of a semiconductor light emitter." Claim 34 recites "at least one optical element stamped on at least one surface of said semiconductor light emitter." Claim 42 recites "an optical element stamped on a surface of said semiconductor light emitter." Each of these claims recites stamping an optical element, Fresnel lens, or holographic diffuser on a surface of a semiconductor light emitter. As described above, such surfaces are generally crystalline and extremely hard. In contrast, it is well known that photoresist, even when exposed, is much softer than a semiconductor layer. Accordingly, a person of skill in the art would not be motivated to use the "stamping block" taught by Shimada et al. to stamp a surface of a semiconductor emitter, because a person of skill in the art would expect that stamping with such a stamping block would not be successful. Accordingly, claims 3, 27, 34, and 42 are patentable over the combination of Paoli and Shimada et al. Claims 28-30 depend from claim 27 and are therefore allowable for at least the same reason.

Claim 45 recites "stamping an optical element in a material, said material being transparent to light emitted from said light emitting device, said material being one of high index optical glass, III-V semiconductors, II-VI semiconductors, group IV semiconductors, high-index organic semiconductors, high index organic compounds, and mixtures or alloys thereof; and bonding said material to a semiconductor light emitter." Paoli teaches at column 12, lines 27 and 28, "fresnel lenses 178 are formed on the exposed n-contact layer 180" of a device. Thus, Paoli does not teach "stamping an optical element in a material . . . and bonding said material to a semiconductor light emitter" as recited in claim 45, since Paoli forms the lens as part of the device, not as a separate piece that is later bonded to a semiconductor light emitter.

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Shimada et al. teaches at column 8, lines 5-8 "The transparent substrate having the Fresnel lens array formed in the manner described above is bonded to the transparent substrate 70 incorporating the photosensors 50 to complete the image sensor." See column 8,

line 11. Shimada et al. also teaches a stamping block formed from photoresist, as described above.

As described above, a person of skill in the art would not expect Shimada et al.'s stamping block to be strong enough to stamp surfaces of semiconductor emitters such as the contact layer in which Paoli's Fresnel lens is formed. Accordingly, a person of skill in the art would not expect that Shimada et al's stamping block would be able to successfully stamp a Fresnel lens in Paoli's GaAs contact layer. In addition, separately forming a Fresnel lens then bonding the lens to a device as taught by Shimada et al. would significantly complicate the fabrication of Paoli's device over Paoli's technique of etching or milling the lens during fabrication of the device. Accordingly, a person of skill in the art would not be motivated to combine Paoli and Shimada et al. to achieve a method of "stamping an optical element in a material, said material being transparent to light emitted from said light emitting device, said material being one of high index optical glass, III-V semiconductors, II-VI semiconductors, group IV semiconductors, high-index organic semiconductors, high index organic compounds, and mixtures or alloys thereof; and bonding said material to a semiconductor light emitter" as recited in claim 45, because such a method would not be expected to work and would significantly complicate fabrication of the device. Claim 45 therefore distinguishes over the combination of Paoli and Shimada et al. Claim 46, 47, 50 and 51 depend from claim 45 and are therefore similarly allowable.

Paoli, Shimada et al., Tomomura et al. 103(a) rejection

Claim 44 is rejected under 35 U.S.C. 103(a) as being unpatentable over Paoli in view of Shimada et al., and in further view of Tomomura et al. Applicants respectfully traverse the rejection. Claim 44 recites "one optical element stamped on a surface of said semiconductor light emitter." As recited above, it would not have been obvious to use Shimada et al.'s

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stamping block to stamp Paoli's semiconductor layer, because a person of skill in the art would expect that such a stamping block would not be strong enough to stamp semiconductor. Tomomura et al. add nothing to the deficiencies of Paoli and Shimada et al. with respect to the above-quoted element of claim 44. Accordingly, claim 44 distinguishes over the combination of Paoli, Shimada et al., and Tomomura et al.

Applicants thank the Examiner for indicating that claims 31-33 are allowable.

In view of the above arguments, Applicants respectfully request allowance of all pending claims. Should the Examiner have any questions, the Examiner is invited to call the undersigned at (408) 382-0480.

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ATTACHMENT A

IN THE CLAIMS

Claims are amended as follows:

2. (Amended) The method of claim [1] 3 wherein said semiconductor light emitter has at least one light extraction surface from where light is intended to be extracted, and wherein said forming is done on at least one extraction surface of said semiconductor light emitter.

3. (Amended) A method of forming a light emitting device, said method comprising:

forming at least one of Fresnel lens and holographic diffuser on at least one surface of a semiconductor light emitter to affect light emitted by said semiconductor light emitter; [The method of claim 1]

wherein said forming comprises pressing a stamping block against at least one surface of said semiconductor light emitter.

4. (Amended) The method of claim [1] 3 wherein said forming is executed concurrently with a wafer-bonding process, said wafer-bonding process comprising:

removing a first substrate of said semiconductor light emitter; and

bonding a second substrate to said semiconductor light emitter.

5. (Amended) A method of forming a light emitting device, said method comprising:

forming at least one of Fresnel lens and holographic diffuser on at least one surface of a semiconductor light emitter to affect light emitted by said semiconductor light emitter;

[The method of claim 1] wherein said forming comprises at least one method selected from [etching, milling,] ablation, machining, scribing, electron discharge machining, and stamping.

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8. (Amended) The method of claim [7] 1 wherein said semiconductor light emitter has a light emitting layer, the method further comprising confining light emission to a preselected section of said light emitting layer, wherein said confining comprises at least one method selected from applying the Holonyak process, using selective area growth, using selective area bonding, using diffusion, and using ion implantation.

9. (Amended) The method of claim [1] 3 further comprising:

coating one or more surfaces of said semiconductor light emitter with a reflective material.

10. (Amended) The method of claim [1] 3 further comprising:

coating said Fresnel lens or said holographic diffuser with a reflective material.

12. (Amended) A light emitting device comprising:

a semiconductor light emitter; and

a first optical element [forming] stamped on at least one surface of said semiconductor light emitter, said first optical element comprising one of Fresnel lens and holographic diffuser.

41. (Amended) A light emitting diode array comprising a plurality of light emitting devices, a light emitting device comprising:

a semiconductor light emitter; and

one of a Fresnel lens and a holographic diffuser [formed] stamped on a surface of said semiconductor light emitter.

43. (Amended) A display device comprising at least one blue light emitting device, at least one green light emitting device, and at least one red light emitting device, wherein at least one of said blue light emitting device, green light emitting device, and red light emitting device comprises:

a semiconductor light emitter; and

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one of a Fresnel lens and a holographic diffuser [formed] stamped on a surface of said semiconductor light emitter.

45. (Twice Amended) A method for forming a light emitting device, said method comprising:

stamping an optical element in a material, said material being transparent to light emitted from said light emitting device, said material being one of high index optical glass, III-V semiconductors, II-VI semiconductors, group IV semiconductors, high-index organic semiconductors, high index organic compounds, and mixtures or alloys thereof; and

bonding said material to a semiconductor light emitter.

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